

STUDIES ON MACQUARIE ISLAND LICHENS 1: GENERAL

by

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INTRODUCTION

This article serves as an introduction to a series of papers on the taxonomy and distribution of Macquarie island lichens, and includes a key to all lichen genera recorded from this Island. Future papers will present the results of the author's revisions.

GEOGRAPHY

Macquarie Island is situated in the Southern Ocean on longitude $158^{\circ} 52' E$ and between latitudes $54^{\circ} 29' S$ and $54^{\circ} 47' S$. It is the southern-most island in the chain comprising Bluff, Stewart, Snares, Auckland and Campbell Islands which stretch south from New Zealand along the New Zealand Plateau—Macquarie—Balleny Ridge. It lies approximately 1530 kilometres south-south-east of Tasmania, Australia, and about 1370 kilometres north of the Antarctic Continent (Fig. 1).

The island, a dependency of Tasmania, is 34 kilometres long and 7 kilometres wide at its widest point (Fig. 2). The main body of the island consists of a large central plateau, about 250 metres above sea level, which is undulate on the top and divided into two halves by a low col. The southern half is the highest, rising to a maximum 433 metres at Mount Hamilton. The plateau area is covered with grass and herbs and is studded with lakes and tarns. The edge of the plateau drops abruptly into the sea on the western side, separated from it by tumbled rocks or in places a narrow shingle beach. By comparison the eastern escarpment drops steeply down onto a wide raised beach terrace.

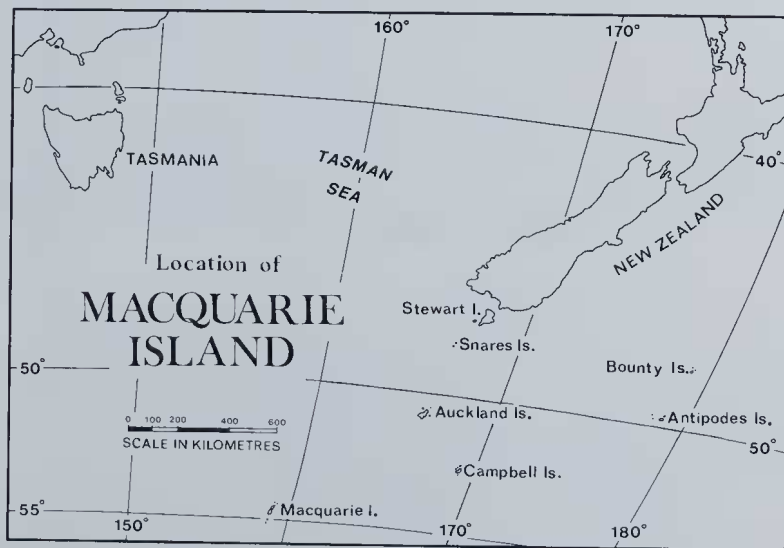


Fig. 1. Location of Macquarie Island.

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This subantarctic island lies north of the Antarctic Convergence, and is subject to persistent wind and cloud cover. There is little bright sunshine and it is mostly wet and cold. Rain, drizzle, snow and hail are frequent. The annual precipitation is 1020 mm. Temperatures fluctuate from near 0°C to about 15°C and the daily range is rarely more than 3.5°C.

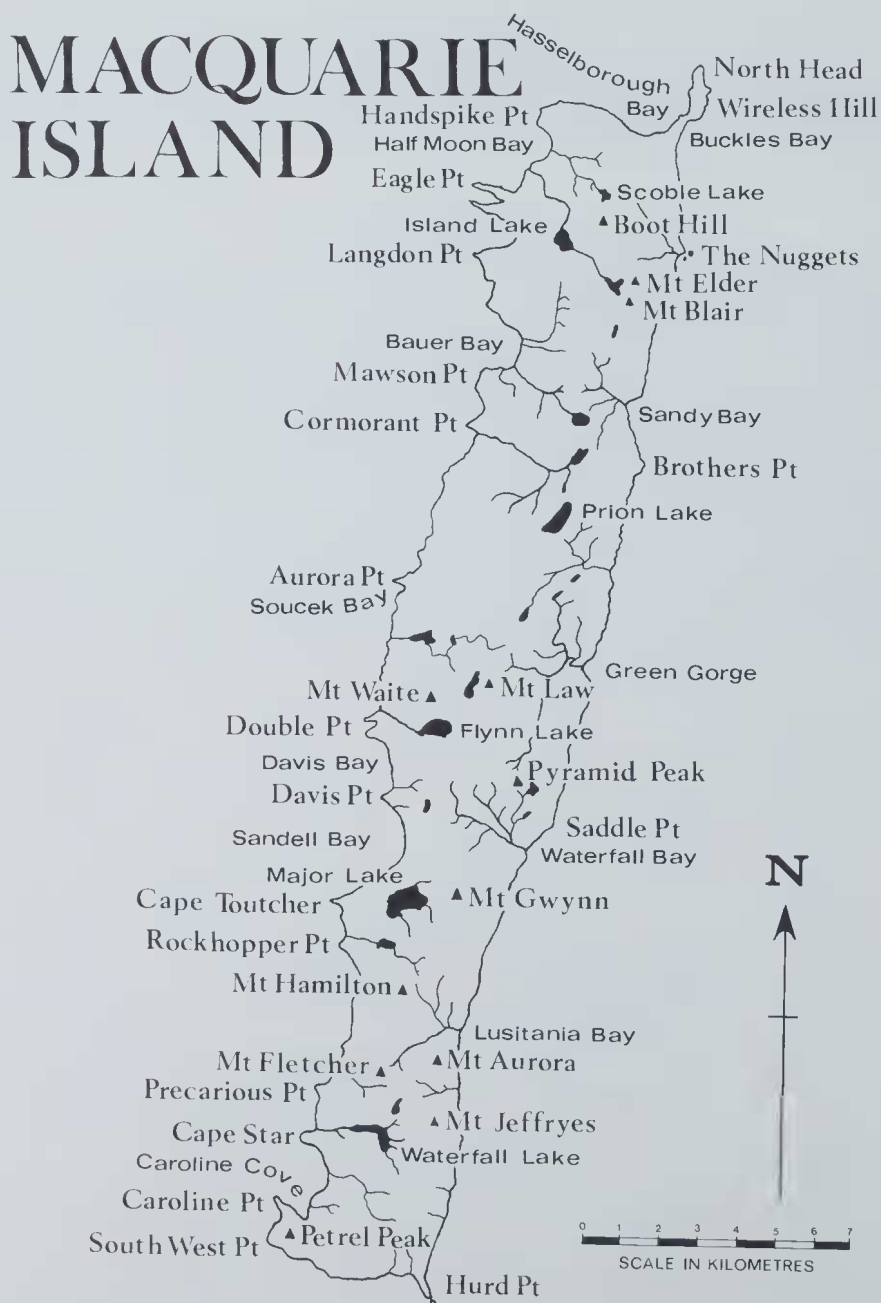


Fig. 2. Macquarie Island.

HISTORY

On 11 July 1810 Macquarie Island was sighted for the first time from the deck of the brig *Perseverance* under the command of Captain Fredrick Hasselburgh (Law & Burstall, 1956: 1). The *Perseverance* was en-route from Sydney to Campbell Island with provisions and stores for the sealers working on that island.

Hasselburgh named this new island after Lachlan Macquarie, then Governor of the Colony of New South Wales. He landed a party of eight men with provisions and salt; this gang was the first of many to engage in the steady slaughter of the fur seals which inhabited the island. Exploitation of the fur seals continued for the next ten years, by which time they were nearly exterminated.

It was at this time that the Australian sealing companies turned their attention to the sea elephants, killing them for their oil. By 1834 when the elephant seal was no longer present in workable numbers, the sealing ventures on the island had almost ceased (Cumpston 1968: 70-72).

On 10 January 1840, the United States Exploring Expedition of 1838-1842 under the command of Lieutenant Charles Wilkes arrived at the island. He found the place "... dreary and inhospitable."

The next fifty years saw very little activity in the seal-oil industry on Macquarie Island. The *Jessie Niccol* owned by Cormack, Elder and Company, under the directorship of William Elder, a New Zealand chemist, visited the island several times for oil. Joseph Hatch, also a New Zealander, reopened the industry in 1873 taking over the operations of the Elder Company. The production of seal oil and penguin oil continued under his direction until 1919. The licence to kill seals and penguins on the island was cancelled on 2 February 1920 (Cumpston 1968: 316).

Captain R. F. Scott, en-route to the Antarctic Continent in the *Discovery*, paid a short visit to the island on 22 November 1901 and the British Antarctic Expedition 1907-1909, led by Sir E. H. Shackleton, landed at Lusitania Bay. Both of these visits were very brief.

On 11 December 1911, the Australasian Antarctic Expedition (A.A.E.), under the leadership of Sir Douglas Mawson set up a scientific base on the isthmus at the foot of Wireless Hill and members of this expedition spent two years on the island.

The British, Australian and New Zealand Antarctic Research Expedition (B.A.N.Z.A.R.E.) 1929-1931, also led by Sir Douglas Mawson, landed in Buckles Bay on 2 December 1930 for a short stay.

Macquarie Island was declared a Sanctuary for animals and birds on 17 May 1933 upon the recommendation of the Animals and Birds Protection Board of Tasmania. It was not revisited until 7 March 1948 when H.M.A.S. *Labuan* arrived with the first Australian National Antarctic Research Expedition (A.N.A.R.E.). This expedition established a station, at the site of the previous A.A.E. base, which has been continuously occupied since its formation.

HISTORY OF LICHENOLOGICAL INVESTIGATIONS

Macquarie Island has been visited by a number of scientific expeditions in the course of its short history. Few of the early expeditions contributed greatly to the knowledge of the lichen flora. The first known collection of Macquarie Island plants was forwarded to Sir W. J. Hooker at Kew in about 1830, by the Superintendent of the Sydney Botanic Gardens (Cheesman 1919: 10). The eight species mentioned in this publication are only of vascular plants.

Dr. J. H. Scott of Otago University, New Zealand, made a brief visit in 1880 for the special purpose of investigating the flora and fauna, and to him is credited the first observations of the lichens of this island (Scott, 1882):

"*Azorella selago* grows on the hillsides forming globular masses often 4 feet across. These are green on the surface where the living part of the plant lies as a crust to the great mass of debris which forms the interior. This is the decaying remains of former years growth . . . The whole makes a solid mass on which

one can stand . . . The young shoots are closely packed together and made so uniform a surface that lichens and other small plants are sometimes found growing on it."

The following is the list of lichens included in his report:

Stereocaulon ramulosum; *Sphaerophoron coralloides* (?); *Cladonia cariosa*; *Cladonia pyxidata*; *Parmelia parietina*; *Lecanora parella*; *Lecidea coarctata*.

In 1894, **A. Hamilton**, then Registrar of the Otago University, visited Macquarie Island, but unfortunately a portion of his collections had to remain on the island for some months after his return. When the remainder of his collection eventually arrived in New Zealand . . .

"The mosses and lichens collected were so injured by the wet, and by the delay of some months which occurred before they were brought up from the island, that I fear it will probably be impossible to give a list of any value." (Hamilton 1895: 569).

The Australasian Antarctic Expedition 1911-1914, established a base on Macquarie Island and the expedition's biologist **H. Hamilton** (son of the former Hamilton) made a collection of lichens. Five fragmentary specimens were sent to Dr. C. W. Dodge at the Missouri Botanical Garden, U.S.A. who published his determinations in the BANZARE Reports (Dodge, 1948):

Pseudocyphellaria glabra (Hook.f. & Tayl.) Dodge; *Stereocaulon corticulatum* Nyl.; *Stereocaulon* sp. [later *S. macquariensis* Dodge (Dodge, 1968)]; *Parmelia sublugubris* Dodge; *Cladia aggregata* (Sw.) Nyl.

The remainder of the collection was erroneously forwarded to the British Museum and was unfortunately destroyed by bomb blast during the blitz of London (Dodge, 1948: 5, 13 footnote).

The British, Australian and New Zealand Antarctic Expedition of 1929-1931 collected almost 100 samples, which were sent to Dodge in Missouri. In the BANZARE Reports he described ten species as new (Dodge, 1948); these are marked with an asterisk in the following list of species:

**Buellia mawsoni* Dodge; *Cladia aggregata* (Sw.) Nyl.; **Cladonia mawsoni* Dodge; *Cladonia sarmentosa* (Tayl.) Dodge; *Cladonia subdigitata* Nyl. var. *subalbinea* Dodge; *Coccocarpia kerguelensis* Dodge; *Coenogonium subtorulosum* Müll. Arg.; **Gasparrinia macquariensis* Dodge; **Lecania johnstoni* Dodge; *Mastodea* sp. [later *M. macquariensis* Dodge (Dodge 1970)]; *Menegazzia circumsorediata* Santesson; **Microthelia macquariensis* Dodge; *Mykoblastus campbellianus* (Nyl.) Zahlbr.; *Pannaria* sp.; *Parmelia sublugubris* Dodge; *Parmelia tenuirima* Hook.f. & Tayl.; *Peltigera* sp.; *Pertusaria tyloplaca* Nyl.; *Pseudocyphellaria glabra* (Hook.f. & Tayl.) Dodge; *Psoroma versicolor* Müll. Arg.; *Pyrenodesmia inclinans* (Stirt.) Dodge; *Pyrenodesmia subpyracea* (Nyl.) Dodge; **Ramalina banzarensis* Dodge; *Ramalina inflata* Hook.f. & Tayl.; *Rinodina peloleuca* Nyl.; *Rinodina subbadioatra* (Knight) Dodge; **Siphulastrum cladinoideis* Dodge; **Siphulastrum usneoides* Dodge; *Stereocaulon corticulatum* Nyl.; *Stereocaulon leptaleum* Nyl.; **Stereocaulon pulvinare* Dodge; *Stereocaulon submollescens* Nyl.; *Thelidea* sp.; *Usnea arida* Mot. var. *musciola* Dodge; *Usnea contexta* Mot.; *Usnea torulosa* (Müll. Arg.) Zahlbr.; *Usnea zanthopoga* Nyl.

Since the ANARE station has been occupied several people including **N. R. Laird**, 1948, **N. M. Haysom**, 1949 and **D. A. Brown**, 1956 have made small collections of lichens. These collections were also forwarded to Dodge and a further twenty-four species were described as new to science (Dodge & Rudolph, 1955; Dodge, 1968, 1970):

Bacidia macquariensis Dodge; *Blastenia macquariensis* Dodge; *Caloplaca macquariensis* Dodge; *Catillaria rudolphi* Dodge; *Chiodecton acarosporoides* Dodge; *Chiodecton macquariensis* Dodge; *Kutlingeria macquariensis* Dodge; *Lecanora brownii* Dodge; *Lecanora procifera* Dodge; *Lecidea haysomi* Dodge; *Lecidea macquariensis* Dodge; *Omphalodina macquariensis* Dodge; *Opegrapha macquariensis* Dodge; *Parmelia brownii* Dodge; *Parmelia haysonii* Dodge; *Parmelia macquariensis* Dodge; *Peltigera lairdi* Dodge; *Phlyctis macquariensis* Dodge; *Phyllopyrenia macquariensis* Dodge; *Physcia macquariensis* Dodge; *Porina macquariensis* Dodge; *Psoroma macquariensis* Dodge; *Squamarina haysonii* Dodge; *Thamnolecania macquariensis* Dodge & Rudolph.

There were also five new records added to the list:

Lecidea subglobulata Knight; *Parmelia turgidula* Bitter; *Placopsis perrugosa* (Nyl.) Nyl.; *Ramalina geniculata* Hook.f. & Tayl.; *Stereocaulon argodes* Nyl.

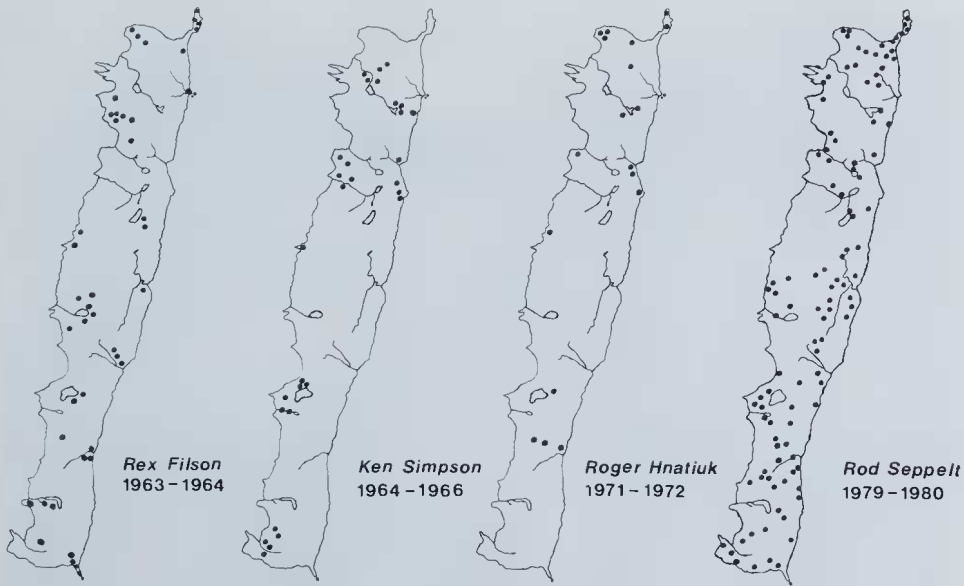


Fig. 3. Collecting sites of the major lichen collectors on Macquarie Island.

From 1963 collecting has been carried out systematically on Macquarie Island. **R. B. Filson** spent one day there in March 1963 and four months from December 1963 to March 1964, collecting extensively all around the island (Fig. 3). **K. S. Simpson** made numerous collections from widely scattered localities during the 16 months from December 1964 to March 1966. **R. J. Hnatiuk** spent December 1971 and January 1972 making comparison studies of alpine grassland regions. He collected 240 samples of lichen from 15 separate localities. **D. A. Parker** collected a number of specimens during 1971 and **R. Waterhouse** collected at the north of the island in 1972.

D. S. Horning was biologist with the Australian Museum Macquarie Island Expedition during the summer of 1977-78. The lichen specimens were determined by D. J. Galloway and the results published by the Museum (Lowry et al., 1978). The following is the list of species not previously reported for the region:

?*Argopsis megalospora* Th. Fr.; *Cladonia auerii* Räs.; *C. contocraea* (Flörke) Spreng.; *C. cornuta* (L.) Hoffm.; *C. fimbriata* (L.) Fr.; *C. foliacea* (Huds.) Willd.; *Endocraena informis*; *Hypogymnia lugubris* (Pers.) Krog.; *Lecanora parmelina* Zahlbr.; *Mastodia tessellata* Hook. & Harv.; *Parmelia* (*Pseudoparmelia*) *caperata* (Hoffm.) Ach.; *Parmelia cunninghamii* Cromb.; *P. signifera* Nyl.; *Parmelia* (*Hypotrachyna*) *sinuosa* (Sm.) Ach.; *Peltigera horizontalis* (Huds.) Baum.; *P. rufescens* (Weis) Humb.; *Pertusaria dactylina* (Ach.) Nyl.; *Pseudocyphellaria delisea* (Fée in Del.) Gall. & James; *Psoroma hypnorum* (Hoffm.) S. Gray; *Siphulastrum mamillata* [unpublished ms. name]; *Sphaerophorus globosus* (Huds.) Vain.; *S. melanocarpus* (Sw.) DC.; *S. ramulifer* M. Lamb; *Thamnolia vermicularis* (Sw.) Schaer.; *Usnea* (*Neuropogon*) *antarctica* DuReitz; *Usnea glomerata* Mot.; *Usnea* (*Neuropogon*) *laxissima* Dodge; *Xanthoria elegans* (Link.) Th. Fr.

R. D. Seppelt spent a few days during November-December 1975 at Macquarie Island when he collected a few lichen samples. He was again on the Island for the 1979-80 summer period collecting bryophytes and lichens; he collected 197 specimens from 108 localities (Fig. 3).

PRINCIPAL VEGETATION FORMATIONS

The vegetation of Macquarie Island can be divided into five main formations: wet tussock grassland, herffield, fen, bog and feldmark (Taylor, 1955). Brief notes



Fig. 4. Coastal rock stacks between Bauer Bay and Douglas Point showing abundance of species; dominant lichen is *Parmelia sulcata*. Photo: Ken Simpson.



Fig. 5. View from Mount Law towards Mount Blake (far middle-distance) and Mount Hamilton (left, far distance) showing lichen-covered plateau outcrops (left and right foreground), fieldmark skirted by cushions of *Azorella* and *Racomitrium* (centre foreground), and plateau herbfield (middle distance). ANARE photo: R. D. Seppelt.

are given below for these, together with the dominant lichen genera occurring in each location.

WET TUSSOCK GRASSLAND:

The wet tussock grassland is found on all steep coastal slopes to an altitude of about 300 metres, on some inland slopes protected by severe winds and on coastal raised beach terraces, except where there is a high water table. This alliance is dominated by *Poa foliosa* and *Stilbocarpa polaris* with *Polystichum vestitum* and *Poa hamiltonii* as minor components in a few localities. The lichens in this alliance are few and are restricted to the bare earth patches between the tussocks or on rocky outcrops emerging from the grass canopy. On the bare patches of earth *Cladonia*, *Baeomyces* and *Peltigera* can be found associated with debris and roots.

The rock outcrops though not strictly part of the grassland have a wider lichen flora including *Psoroma*, *Cladonia*, *Lecidea*, *Lecanora*, *Usnea*, *Ramalina*, *Hypogymnia* and *Menegazzia*.

The maritime communities have been grouped by Taylor (1955: 49) as a separate association under this alliance. The coastal rocks in the splash zone have a large number of crustose species: *Microthelia*, *Caloplaca*, *Placopsis*, *Lecanora*, and *Lecidea* are common. The old sea stacks, e.g. The Nuggets, have many additional genera, *Menegazzia*, *Peltigera*, *Pseudocyphellaria*, *Parmelia* and *Graphis*. These are mostly found on the sheltered side and top.

The cliffs at the edge of the plateau and the plateau outcrops provide the richest lichen flora on the island. *Usnea*, *Stereocaulon*, *Parmelia*, *Hypogymnia*, *Menegazzia*, *Caloplaca*, *Lecidea*, *Rhizocarpon*, *Lecanora*, *Microthelia* and several other crustose genera grow on these rocky faces which are abundantly covered with lichens.

HERBFIELD:

The herbfield alliance is found in areas with a relatively high water table and moderate wind exposure at all altitudes up to 350 metres. It is dominated by *Pleurophyllum hookeri*; however the floristic composition varies greatly. In general the lichen flora is scarce; *Baeomyces*, *Psoroma*, *Lecidea*, and *Cladonia* are found recolonising bare patches of soil between the herbfields while the low branchlets of *Coprosma pumila* and other low bushes are the habitat for *Usnea*, *Hypogymnia*, *Cladia*, *Pseudocyphellaria* and *Sphaerophorus*.

FEN:

Juncus scheuchzerioides is the characteristic dominant vascular species of the fen alliance which occurs locally in valley bottoms on the plateau and in isolated areas on the raised beach terraces. This alliance is very poor in lichen species; occasional patches of *Psoroma* or *Cladonia* are seen growing on dryer peat patches but in general the areas are too wet for lichen growth.

BOG:

The bog alliance occurs locally at all elevations on the island where there is an acidic water table at or above ground surface level. The lichens here are restricted to elevated and better drained areas within the alliance; *Hypogymnia*, *Usnea*, *Cladonia*, *Cladia*, *Pseudocyphellaria*, *Lecidea* and *Psoroma* are found growing over and amongst mosses and *Colobanthus muscoides*. Species of *Stereocaulon*, *Placopsis*, *Rhizocarpon* and *Lecidea* are common on rocks beside small streams.

FELDMARK:

Feldmark is found in all areas subject to high wind velocities at all altitudes and covers the greater part of the island above 180 metres. The dominant lichens are: *Usnea*, *Sphaerophorus*, *Cladonia*, *Cladia*, *Hypogymnia*, *Pseudocyphellaria*, *Lecidea*, *Baeomyces* and *Psoroma*. *Pertusaria* and other crustose genera grow on the

cushions of *Azorella selago*. Moss cushions sometimes provide habitat for small crustose species. Foliose and fruticose species occur amongst the pebbles and gravels of the bare patches on the slopes; here the dominant genera are *Hypogymnia*, *Stereocaulon*, *Lecanora*, *Lecidea*, *Rhizocarpon* and *Placopsis*. Some crustose species assume a fruticose habit because of the harsh environmental conditions. These will be discussed in more detail in later papers when individual genera are considered.

ARTIFICIAL KEY TO THE LICHEN GENERA ON MACQUARIE ISLAND

1. Thallus fruticose or squamulose
 2. Thallus fruticose
 3. Primary thallus granulate crustose
 4. Apothecia sessile
 5. Cephalodia present *Placopsis*
 5. Cephalodia absent *Aspicilia*
 4. Apothecia terminal on erect podetia *Baeomyces*
 3. Primary thallus lacking or not granulate-crustose
 6. Thallus hollow
 7. Primary thallus absent
 8. Thallus not inflated or lacerate
 9. Thallus a shade of brown with regular patterns of perforations through the outer walls *Cladia*
 9. Thallus a shade of grey with black markings and without perforations *Hypogymnia*
 8. Thallus much inflated and somewhat lacerate, perforations in walls very irregular; on coastal outcrops *Ramalina*
 7. Primary thallus erect and subfoliose, apothecia on cup-shaped pseudopodetia *Cladonia*
 6. Thallus solid
 10. Thallus less than 1 cm tall
 11. Thallus more or less terete, of uniform colouring
 12. Thallus a shade of white or yellowish-white
 13. Thallus with cephalodia *Stereocaulon*
 13. Thallus without cephalodia *Thamnolecania*
 12. Thallus a shade of yellow or orange *Caloplaca*
 11. Thallus dorsiventral one side a shade of green or brown, the other pale
 14. Thallus without cephalodia
 15. Thallus distinctly isidiose *Massalongia*
 15. Thallus not isidiose *Cladonia*
 14. Thallus with dark coloured cephalodia *Psoroma*
 10. Thallus greater than 1 cm tall
 16. Thallus with central chondroid axis
 17. Thallus a shade of white, pink or greyish-white with cephalodia *Stereocaulon*
 17. Thallus a shade of yellow, yellow-green or green and black, without cephalodia *Usnea*
 16. Thallus without a central chondroid axis
 18. Thallus green, yellow-green or brownish green
 19. Thallus dorsiventral, strap-like
 20. Thallus with distinct soralia *Ramalina*
 20. Thallus with dorsiventral lobulate branching at the margins *Sphaerophorus*
 19. Thallus forming cups, not strap-like *Cladonia*

- 18. Thallus a shade of white, pink or brownish white
 - 21. Thallus hollow or compactly filled with medulla, lacking cephalodia
 - 22. Thallus hollow with perforations in the axils of the branches *Cladonia*
 - 22. Thallus compactly filled with medulla axils not perforated *Sphaerophorus*
 - 21. Thallus with tough chondroid axis, cephalodia pink to pale grey *Stereocaulon*
- 2. Thallus foliose
 - 23. Phycobiont blue-green
 - 24. Thallus gelatinous when wet
 - 25. Phycobiont *Nostoc*
 - 26. Cortex distinctly cellular *Leptogium*
 - 26. Cortex of interwoven hyphae *Collema*
 - 25. Phycobiont *Xanthocapsa* *Thyrea*
 - 24. Thallus not gelatinous when wet
 - 27. Lower surface not veined
 - 28. Thallus lobes small, less than 5 mm wide, margins divided, isidiose, lobulate
 - 29. Apothecia lecanorine, margin prominent *Pannaria*
 - 29. Apothecia lecideine, margin disappearing *Massalongia*
 - 28. Thallus lobes large, up to 1 cm wide margins entire *Erioderma*
 - 27. Lower surface veined *Peltigera*
 - 23. Phycobiont green
 - 30. Lower surface smooth shining
 - 31. Thallus hollow
 - 32. Upper surface white to yellowish-white with perforations into the central cavity *Menegazzia*
 - 32. Upper surface grey with black markings without perforations *Hypogymnia*
 - 31. Thallus solid
 - 33. Lower surface white *Cetraria*
 - 33. Lower surface black *Platismatia*
 - 30. Lower surface ecorticate, tomentose or rhizinate
 - 34. Thallus small, less than 10 mm tall, subfruticose
 - 35. Thallus with dark coloured cephalodia *Psoroma*
 - 35. Thallus without dark coloured cephalodia *Cladonia* (primary thallus)
 - 34. Thallus distinctly foliose
 - 36. Lower surface with rhizines
 - 37. Lower surface black *Parmelia*
 - 37. Lower surface pale *Physcia*
 - 36. Lower surface tomentose with pseudocyphellae *Pseudocyphellaria*
- 1. Thallus squamulose or crustose
 - 38. Fruiting body stipitate, on podetia or pseudopodetia
 - 39. Ascospores many per ascus
 - 40. Exciple pale, soft *Biatorella*
 - 40. Exciple black, brittle *Sarcogyne*
 - 39. Ascospores eight per ascus
 - 41. Thallus crustose, apothecia sessile *Icmadophila*
 - 41. Thallus a fine powdery crust, apothecia stipitate *Baeomyces*
 - 38. Fruiting body immersed, adnate or sessile
 - 42. Ascospores more than eight per ascus

- 43. Apothecia adnate or sessile
 - 44. Exciple pale, soft *Biatorella*
 - 44. Exciple black, brittle *Sarcogyne*
- 43. Apothecia immersed *Acarospora*
- 42. Ascospores one to eight per ascus
- 45. Ascospores simple, unilocular
- 46. Thallus squamulose
 - 47. Phycobiont blue-green
 - 48. Apothecia lecideine *Parmeliella*
 - 48. Apothecia lecanorine *Pannaria*
 - 47. Phycobiont green
 - 49. Apothecia sessile to adnate
 - 50. Apothecia lecideine *Lecidea*
 - 50. Apothecia lecanorine *Psoroma*
 - 49. Apothecia immersed *Trapelia*
- 46. Thallus crustose
 - 51. Phycobiont green
 - 52. Fruiting body an apothecium
 - 53. Apothecia immersed in thallus or in warts
 - 54. Apothecia immersed but not in warts
 - 55. Paraphyses unbranched *Aspicilia*
 - 55. Paraphyses branched and anastomosing ... *Trapelia*
 - 54. Apothecia immersed in thalline warts *Pertusaria*
 - 53. Apothecia adnate to sessile
 - 56. Disk of apothecium K- or K+ but not K+ purple
 - 57. Apothecia lecanorine
 - 58. Thallus with cephalodia *Placopsis*
 - 58. Thallus without cephalodia *Lecanora*
 - 57. Apothecia lecideine *Lecidea*
 - 56. Disk of apothecium K+ purple *Caloplaca*
 - 52. Fruiting body a perithecium *Verrucaria*
 - 51. Phycobiont blue green *Pyrenopezidium*
- 45. Ascospores septate or polaribilocular
- 59. Fruiting body a perithecium or perithecium-like
- 60. Ascospores many-celled
 - 61. Ascospores transversely septate only
 - 62. Fruiting bodies immersed in stromatic warts *Trypethelium*
 - 62. Fruiting bodies not immersed in stromatic warts . *Arthopyrenia*
 - 61. Ascospores transversely and longitudinally septate
 - 63. Ascospores hyaline *Polyblastiopsis*
 - 63. Ascospores brown *Anthracotheicum*
 - 60. Ascospores two-celled *Microthelia*
- 59. Fruiting body not perithecial
- 64. Fruiting body round or misshapen by pressure
- 65. Ascospores hyaline
 - 66. Apothecia lecanorine
 - 67. Ascospores polaribilocular *Caloplaca*
 - 67. Ascospore walls not thickened *Icmadophila*
 - 66. Apothecia lecideine
 - 68. Ascospores polaribilocular, two-celled
 - 69. Ascospore walls not thickened

- 70. Thallus crustose
 - 71. Apothecial disk pale to dark not orange
 - 72. Apothecia less than 1 mm diam.....*Catillaria*
 - 72. Apothecia greater than 1 mm diam.....*Icmadophila*
 - 71. Apothecial disk yellow to orange.....*Dimerella*
- 70. Thallus squamulose*Toninia*
- 69. Ascospores polaribilocular*Blastenia*
- 68. Ascospores more than two-celled
 - 73. Ascospores transversely and longitudinally septate
 - 74. Apothecia black, ascospores grey to brown to black*Rhizocarpon*
 - 74. Apothecia yellow or pale, ascospores hyaline.....*Bombyliospora*
 - 73. Ascospores transversely septate only*Bacidia*
- 65. Ascospores brown
 - 75. Ascospores transversely septate only
 - 76. Apothecia lecideine*Buellia*
 - 76. Apothecia lecanorine*Rinodina*
 - 75. Ascospores transversely and longitudinally septate
 - 77. Apothecia immersed in the thallus or lecanorine*Diploschistes*
 - 77. Apothecia adnate to sessile, lecideine*Rhizocarpon*
- 64. Fruiting body elongate, irregular or star-shaped
 - 78. Ascospores transversely septate only
 - 79. Ascospores brown
 - 80. Ascospores two-celled*Melaspilea*
 - 80. Ascospores more than two-celled*Phaeographis*
 - 79. Ascospores hyaline
 - 81. Fruiting bodies clustered, immersed in stroma
 - 82. Hypothecium dark*Chiodecton*
 - 82. Hypothecium pale*Enterographa*
 - 81. Fruiting bodies single not immersed in stroma
 - 83. Paraphyses branched and anastomosing, exciple usually well developed
 - 84. Ascospores usually two- to four-celled, cells of unequal size.....*Arthonia*
 - 84. Ascospores usually four or more celled, cells uniform*Opegrapha*
 - 83. Paraphyses unbranched, exciple well developed*Graphis*
 - 78. Ascospores transversely and longitudinally septate
 - 85. Ascospores hyaline
 - 86. Paraphyses branched and anastomosing ...*Arthothelium*
 - 86. Paraphyses unbranched *Graphina*
 - 85. Ascospores brown*Phaeographis*

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